

on Mechanics always used the expressions "accelerating force" and "moving force" (to the great confusion of learners), with the noteworthy exception of Sandeman's "Motion of a Particle," where "effect" was used for "force." So troublesome and misleading was this terminology found for students that one well-known Cambridge writer in a little work on Dynamics, introduced it in a way which reminds one of the trembling and caution with which Sidney Smith brought the word "metaphysics" before his audience at the Royal Institution. But these authors could claim the venerable authority of Newton for those terms; and if they had taken care to introduce them in the *exact way in which he does*, no difficulty would have ensued. Unfortunately, until Mr. P. T. Main edited Newton's "Sections," our editions of that work began with Lemma I., and ignored his "Definitions" and "Laws of Motion." In the "Definitions" Sir I. Newton tells us that the term "accelerative force" is used as an abbreviation for "the accelerative quantity of a force," or the velocity generated by it in a given time; and the term "moving" or "motive force" as an abbreviation for "the motive quantity of a force," or the momentum generated by it in a given time; and if these expressions had always been explained in this way, *i.e.* as signifying what may be called the *velocity-effect* and the *momentum-effect* of a force, there would have been no room for misconception and no need of cautioning the learner against the notion that there were *two different kinds* of force. Perhaps with regard to Leibnitz it may be questioned whether his physical ideas were so incorrect, and whether he may not have used the terms referred to in the same way that Newton did, *viz.*, as abbreviations, and so as to embody the notions of the different *effects* of a power or influence on the motion of a body, *viz.*, its work-effect, its momentum-effect, its velocity-effect, &c. It must, however, be allowed that the term "conservation of force" (originally it seems due to Helmholtz) is very misleading, for a meaning of "force" is therein required which is not included in the original dynamical ideas; and the notion intended to be conveyed could only be given by a new term, "energy," or work-power, with its attributives actual and potential. But, after all, the whole controversy on the word "force" is as to the *method of measuring* a pressure or tension; if we regard the *time* of the action, the effect is represented by the momentum; and if the *space* through which exertion is made, the effect is represented by the work.¹ Either of these would then measure "force," and there would be no inaccuracy if careful explanation were given as to the method used and the sense of words.

W. P. O.

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P.S.—In Prof. Tait's view of "force" is there not a confusion between *being* a mere rate and *being measured* by a rate?

[Our correspondent refers merely to the short abstract given by the *Times* of Prof. Tait's Lecture. Some of his remarks will be found inapplicable to the fuller report in our own pages.—ED.]

Mr. Wallace and his Reviewer

IN NATURE, vol. xiv. pp. 188, 189, in a review of Mr. Wallace's recent work on "The Geographical Distribution of Animals," occurs the following paragraph: "Mr. Wallace admits the validity of *Elasmognathus* of Gill as a genus of Tapirs, and adopts Dr. Gray's multitudinous division of the well-defined and eminently natural group of the Eared Seals (*Otaria*). Many naturalists would hesitate before following Mr. Gill or Dr. Gray as authorities on these (or perhaps we may add many other) subjects."

I freely admit the truth of the proposition that there are "many subjects" on which I am not authority, if I am on any; there are none, I presume, who are authority on all things. I will not even contest the allegation as to wrong-doings in regard to the generic differentiation of Baird's tapir; I beg, however, to be allowed to excuse myself by "authority" for such wrong-doing.

The animal in question is distinguished from all others (I have seen skins and skeletons of every known species, and about 100 skulls), and especially from the typical American tapirs by the want of basal apophyses to the nasal bones, the extension of the supramaxillaries behind, into their lowellæ, and their extension upwards into swollen portions, which tightly embrace the mesethmoid, the complete ossification of the latter in the adult; with these features are co-ordinated others less marked, *e.g.*, abbreviation of the cranial box, comparatively small size of the cere-

bral cavity, &c. The genus has been accepted by Prof. Verrill, Dr. von Frantzius, Dr. Murie (see his article in *Journ. of Anat. and Phys.* vol. vi., pp. 131-169), as well as Dr. Gray, and every trained mammalogist and anatomist to whom I have shown the skulls (*e.g.* the late Prof. Agassiz, Prof. Baird, Prof. Cope, E. Coues, Dr. H. Allen, Mr. J. A. Allen) have concurred with me that the type is entitled to generic distinction.

As to the eared seals, the critic is wrong as to a matter of fact. Mr. Wallace has *not* followed Dr. Gray in his arrangement of the constituents of that family, but, as he expressly states, has followed Mr. J. A. Allen's elaborate monograph of the *Otariids* of Western America. Two more different arrangements of the same group could scarcely be. For the generic features of the arrangement adopted, I am quite willing to assume the responsibility which Mr. Allen has devolved upon me,¹ notwithstanding the critic's emphatic condemnation. Beside Dr. Gray and myself, F. Cuvier and many of the other older naturalists, as well as Allen, Scammony Elliott, &c., have recognised generic differences between the *Otariids*.

But over and above all these I can plead in extenuation of my wrong-doing the example of a very eminent and accomplished naturalist, Mr. P. L. Sclater; I feel assured that I am not mistaken in supposing he will be regarded as the best possible authority on such subjects. That zoologist has differentiated the deer into genera distinguished *solely* by the palmation or non-palmation of the horns and many genera of birds on equally slight ground which your limits forbid me to mention. I think no rational naturalist familiar with the details of structure of the deer and tapirs and the variations of horns in the former, will contend that the differences between the tapirs is of less systematic importance than those used to differentiate *Cervus* and *Dama*. Hence I think I have the best precedents for my action, and if I am subject to censure, the eminent Englishman whom I have cited is still more so.

But far be it from me to deny that my critic is not at all correct in his statement (shortly preceding the passage first quoted) that "it would be easy to point out many passages in which Mr. Wallace has not, in our opinion, made the most judicious choice of authorities." One passage (*Op. cit.*, vol. ii. p. 120) I beg to reproduce in corroboration, but, in justice to Mr. Wallace, I must add that although there are many other errors, the passage thus quoted is an exceptional one in a valuable work.

"*Fresh-water Fishes*."²—The Nearctic region possesses no less than (1) five peculiar family types, and (2) twenty-four peculiar genera of this class. The families are *Aphredoderidae*, consisting of a single species found in the (3) Eastern States; *Percopsidae*, founded on a species (4) peculiar to Lake Superior; *Heteropygiti*, containing (5) two genera peculiar to the Eastern States; *Hypodontidae* and *Amiidae*, each consisting of a single species. The genera are as follows: (6) *Paralabrax*, found in California; (7) *Huro*, peculiar to Lake Huron; (8) *Pilcomia*, *Bolosoma*, (9) *Bryttus* and (10) *Pomotis* in the Eastern States—all belonging to the Perch family. (11) *Hypodilus* and *Noturus*, belonging to the *Siluridae*. (12) *Thaleichthys*, one of the *Salmonidae* peculiar to the Columbia River. (13) *Moxostoma*, (14) *Pimephales*, (15) *Hyborhynchus*, (16) *Rhinichthys*, in the Eastern States; (17) *Ericymba*, (18) *Exoglossum*, (19) *Leucosomus*, and (20) *Carpinodes*, more widely distributed; *Cochlognathus*, in Texas; (21) *Mylophorodon* and *Orthodon*, in California; *Meda*, in the River Gila; and *Acrochilus*, in the Columbia River—all belonging to the *Cyprinidae*. *Scaphirhynchus*, found only in the Mississippi and its tributaries, belongs to the sturgeon family (*Acipenseridae*)."

Whatever may be the "authority" followed, the following are the facts almost all familiar to every American ichthyologist, and matters of record respecting the forms enumerated. (1) Five families are mentioned in one place (just quoted), and six in others (*op. cit.*, vol. ii., pp. 115, 143); but the sixth (*Lepidostoridae*) is not peculiar; (2) Twenty-four genera are said to be peculiar, but twenty-nine are enumerated, as is indeed recognised in the next paragraph of the work. (3) The family *Aphredoderidae* is represented by two species found in the Western and Southern as well as Eastern States; (4) The *Percopsidae*, far from being confined to Lake Superior, are found at least as far as Lake Champlain to the east, the

¹ "These [genera recognised by Gill] appear to be natural groups of true generic rank, and properly restricted; and, after a careful examination of the subject, and specimens of four of these five types, they appear to me to include all the natural genera of the family."—Allen, "On the Eared Seals (*Otariidae*)," p. 38.

² The punctuation of the original is reproduced.

¹ "Walton's Mechanical Problems," chap. x.

Potomac River to the south, the Ohio River in the west, and many other places; (5) The *Heteropogon* have three genera (as understood by Putnam, the only naturalist who has thoroughly studied them) confined to the western and southern states; (6) The genus *Paralebrax* is an entirely marine one, very closely related to *Serranus* (*cabrilla*, *scriba*, &c.), and is represented extensively on the western coast of America, as well as elsewhere in the Pacific Ocean; (7) *Huro nigricans* (the only species) is a mere synonym of *Grystes* or *Micropterus nigricans*, which extends to Florida in the south-east, and Mexico toward the south-west; (8) *Pileoma* is a later name for *Percina*; (9) *Bryttus* and (10) *Pomotis* are not *Percida* according to most American authors, nor according to Dr. Günther's recently promulgated views (the vertebræ being only $A 10 + C 14$), and belong to a quite peculiar family; (11) *Hypodelus* is a misnomer for *Hopladelus*; (12) *Thaleichthys* is as much a marine genus as *Osmernus* (Smelts); there is no such restriction at all as indicated by the remarks on the distribution of (13) *Moxostoma*, (14) *Pimephales*, (15) *Hybomrhynchus*, and (16) *Rhinichthys* on the one hand, and (17) *Eriocymba*, (18) *Exoglossum*, (19) *Leucosomus*, (= *Semotilus*), and (20) *Carpiodes* on the other; and the categories might indeed, as to most causes, be almost reversed; (21) *Mylopharodon* is a misnomer for *Mylopharodon*. The number of genera enumerated as peculiar might, too, be very safely more than doubled, and by reference to Günther's work and subsequent corrections, *Centraculus*, *Pyronotus* (= *Triglopsis*), and *Hysterocephalus* could have been added. All these errors might have been prevented if Mr. Wallace had been familiar with ichthyology and its literature. The paragraph cited also quite conceals the remarkable distribution into secondary faunas of the American genera, and is calculated to entirely mislead respecting the contrasts between North America and the Old World. His use of the term "Eastern States" (instead of "Eastern Province," as Baird calls the division meant) is confusing, inasmuch as it is a geographical designation for a particular group of states.

Smithsonian Institution, Washington,
September 21

THRO. GILL

The Self-Fertilisation of Plants

UNDER this title there is an article in NATURE, vol. xiv. p. 475, mentioning some observations on flowers, and concluding thus:—"In view of these examples . . . it can hardly be that colour, fragrance and honeyed secretions in flowers have been developed solely to secure cross-fertilisation." In reply to this article it may be worth showing that of the examples relied upon the first and last are most probably incorrectly observed and erroneously interpreted, whilst the others are of no consequence at all, so far as the good effects of cross-fertilisation are concerned.

First, the flowers of *Browallia elata* have been most accurately described by F. Delpino ("Ulteriori osservazioni sulla dicogamia nel regno vegetale," Parte I. p. 140-143), and this excellent observer has fully convinced himself that it is cross-fertilised whenever it is visited by Lepidoptera or Bombylii.

Claytonia virginica and *Ranunculus bulbosus* simply confirm the well-known fact that many flowers have recourse to self-fertilisation when not visited by insects (see H. Müller's "Befruchtung," p. 443-448, NATURE, vol. viii. p. 433, vol. ix. pp. 44, 64, vol. x. p. 122).

As to the last example, *Ranunculus abortivus*, it is inadmissible to conclude from the fact that one has not observed visitors on a plant, that this plant is wholly neglected by insects.

With regard to the article as a whole, it seems to me somewhat rash to call in question a comprehensive and well-founded theory on the basis of a few superficial observations.

Lippstad, October 20

HERMANN MÜLLER

The Proposed Zoological Stations at Kiel and Heligoland

IN NATURE, vol. xiv. p. 535, there appears amongst the occasional Notes, a short report of a proposal of the Association of German Naturalists to found two new Zoological Stations at Kiel and Heligoland. The establishment of such stations could not fail to be of immense service to biology, but it is much to be regretted that the Association is inclined to put aside the claims of the present Zoological Station at Naples in favour of these two new institutions. To act in this way would be both unwise and ungenerous: unwise, because a station on the shores of the Mediterranean can obtain a great variety of forms which are not

to be found in the North Sea and the Baltic; and ungenerous because the Naples Station has been the means of proving both the value and feasibility of such institutions, and without it the present proposals would never have originated. It is indeed surprising to see a body of German naturalists refusing their support to an institution like that at Naples, which has already rendered such signal services to biology, in which so many of themselves have made important discoveries, and which is, moreover, founded almost on the site of the classical investigations of Kölliker, Gegenbaur, and Hæckel.

It is to be hoped that the Commission appointed by the Association to draw up a memorandum will see their way to urging the claims of the existing Zoological Station at Naples without thereby interfering with the prospects of the similar institutions which it is proposed to found.

F. M. BALFOUR

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The Flame of Chloride of Sodium in a Common Coal Fire

MR. HARDMAN, in NATURE, vol. xiv. p. 506, gives an account of a number of experiments which he considers to bear out the old theory that the blue flame produced by throwing common salt on a coal fire is due to carbonic oxide. His letter induces me to give an account of a series of experiments which I made last winter, in company with Mr. R. A. Lundie, and which led me to an exactly opposite conclusion. Our experiments were all made with the help of a spectroscope, no dependence being put on observations made with the naked eye:—

1. We examined, with the spectroscope (which was a small direct-vision one), a *very distinct* blue flame of CO, burning in a coal fire; this, as far as we could see, gave no bright lines. A little common salt was then put on the fire, when at once a very marked spectrum appeared, the most characteristic part of which was a pair of bright lines in the blue, and another pair in the violet beyond the spectrum of the glowing coals, against which the flame was generally seen. This flame was very persistent, and frequently long after the flame had ceased to be distinguishable, the spectrum was still quite marked.

2. We did not succeed in getting the spectrum with other salts of soda, such as carbonate, phosphate, and borate; nor yet with microcosmic salt, while on the other hand, with other chlorides and chlorates, such as KCl, KClO₃, and NH₄Cl almost exactly the same spectrum was obtained, and with bromide of potassium a very similar, if not an identical, spectrum was also obtained.

3. We were able, but with more difficulty, to get the characteristic spectrum, when a blow-pipe flame was made to play down on chloride of soda, or ammonia, lying on an iron plate; and in this case it was observed that the blue flame *seemed* to be produced only when the flame which had passed over the salt came to a colder part of the plate where there was more salt.

Want of time has prevented me from continuing my experiments, and I do not venture to suggest any theory to account for the phenomenon. It is possible that part of the blue blaze is due to carbonic oxide, but I am convinced that this is not a complete explanation. Neither do I think that Mr. Müller's explanation (NATURE, vol. xiii. p. 448) is sufficient, though a number of our earliest experiments, in which a brass plate took the place of the iron plate (in experiment 3), certainly favour this explanation to a certain extent. The flame thus produced gave the characteristic spectrum very brightly, but at the same time new lines (copper) appeared in the green. I would add that I have as yet been unable to get satisfactory measurements of the positions of the lines, the spectroscope I used for most of my observations having no micrometer nor scale.

C. MICHIE SMITH

Keig, Aberdeenshire, October 13

OUR ASTRONOMICAL COLUMN

THE INTRA-MERCURIAL PLANET QUESTION.—M. Leverrier has made a further communication to the Paris Academy on this subject. With the view to testing the sufficiency of the method employed, to afford a guide for prediction of future transits of such a body over the sun's disk, admitting that the observations in which appreciable motion is recorded really refer to an intra-Mercurial planet, he applies it in the case of Mercury. Trans-